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Pricing Mobility

Experiences in the Netherlands

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Externalities of transport do not only depend on the number of kilometres driven, but also on factors such as road type, time of day, car type and on driving behaviour such as speed and acceleration. The present pricing system of car use and ownership in the Netherlands is such that the degree of differentiation is small, except for the car type aspect. Thus there is a clear mismatch between the differentiation in external costs and in pricing. A considerable share (55%) of all car-related taxes in the Netherlands relates to car ownership. The rest (45%) is paid for car use. The structure of the tax system is only vaguely related to the differentiation in the external effects.
To overcome this problem, variabilisation of the tax system has been a main objective during the past 20 years in the Netherlands. A discussion is given of various ways to achieve this variabilisation such as a spatial graduation of fuel taxes, congestion pricing, a kilometre charge, and paid parking.
The treatment of transport costs as a deductible in the income tax leads to major distortions in the Netherlands: a low variable cost for commuting, a zero variable cost for the company car, and a negative cost in the case of private car use for business purposes.
Thus, two major problems in the taxation of road transport are found: lack of differentiation so that the tariffs do not reflect the external costs, and adverse effects of the structure of the income tax in the fields of business traffic and commuting leading to low, zero or even negative costs of car use. Discussions on the reform of transport-related taxes generally focus on the first problem but the figures presented in this study indicate that the second problem also deserves high priority.

1. Introduction.

Pricing mobility is a subject high on the political agenda of many countries (see, for example EU, 1998; CE, 1999). The issue bears upon such topics such as the appropriate level of fuel

prices, the imposition of congestion charges, and the size of the subsidies to public transport. One might wonder why the public sector is so heavily involved in the mobility market, since direct government involvement in price setting is usually more restricted in most other markets. Because market failures are characteristic of mobility markets, it becomes necessary for various reasons for the public sector to intervene. One of these failures pertains to the negative externalities of transport in terms of noise, accidents, emissions and congestion. These externalities lead to an underestimation of the real costs of mobility and hence to over-consumption. Another reason for government involvement in pricing mobility refers to the non-excludability feature of various infrastructure types: when it is difficult or costly for the user of infrastructure to pay for the use of a particular piece of infrastructure, the private sector will not supply the infrastructure in sufficient volumes. This leads to a more active role of public sector as supplier, and hence raises the problem of how the public sector will price the use of infrastructure.

In addition, the feature of economies of scale in transport leads to monopolistic tendencies. One way to resolve this problem is to introduce public sector-controlled transport companies that offer fair price setting strategies. Finally, equity issues are crucial in some segments of the transport market. Particular groups in society may experience social exclusion from particular activities in the absence of affordable transport services. This may eventually lead to a governmental role in safeguarding the minimum supply of certain basic transport services at reasonable prices.

In the present paper we give a review of pricing issues in the Netherlands. We focus on the pricing of road transport, because it is here that political discussions have been the most intense. Other transport modes are discussed in less detail.

Pricing principles are discussed in section 2. In section 3 we provide a brief account of recent developments in mobility in the Netherlands as well as a comparison of current pricing procedures with the pricing principles in section 2. In section 4 we discuss the issue of policy of variabilisation: i.e., a shift away from a fixed charge for road use towards a system with a higher component of variable costs. Particular examples reviewed are the increased use of fuel charges, a kilometre charge and congestion pricing. After a short assessment of pricing issues in other transport markets in section 5, we discuss some major distortions from other policy fields in section 6. These distortions correspond to the fiscal regimes of company cars and commuting costs. Section 7 concludes.

2. Principles for pricing transport.

Several principles are used in the discussions on the pricing of transport:

- efficiency
- equity 1: balance between what people get and what they pay;
- equity 2: balance between what people need and what they can afford.

The *efficiency principle* states that the optimal level of transport is achieved when the marginal cost of an extra km of transport is equal to the marginal benefit. Since the marginal benefits of transport tend to decrease with the distance travelled, and marginal costs are constant or increasing, there will be a point where marginal costs and benefits converge. Reason for concern is that, due to the external costs mentioned above, travellers are not

incurred with the appropriate level of costs: for example, they tend to ignore noise problems produced by the aircraft in which they travel. This situation leads to over-consumption; a charge for the externality to correct for this would increase the marginal costs as experienced by the traveller, implying a decrease in the distance travelled.

The *equity 1* principle stipulates that there should be a balance between what people pay and what they receive. This principle is often used for road transport. There is a general feeling in many countries that road users pay more than they get in terms of quality of infrastructure available to them, but for public transport services the reverse often holds: the existence of subsidies implies that public transport users get more than they pay.

The *equity 2* principle is used for specific groups, such as handicapped persons, elderly people and persons living in isolated areas (peripheral rural areas, islands, etc.). The discussion in this context is on the extent to which the public sector has a task to correct for the gap between transport needs and the costs of producing the services, and, if such a task has indeed been identified, how to reduce this gap. The problem can be resolved by a lump-sum income transfer, a dedicated transfer of income (e.g., via vouchers used for transport), subsidies on transport activities conducted by the private sector, or the organisation of transport by the public sector itself. The reasons for the large gap between what persons in these groups can afford to pay and what the transport services cost emerge from two entirely different sources. The first factor is that the income of the groups in question is usually low (most handicapped people depend on social welfare payments; isolated areas may well have low average income levels). The second factor pertains to the costs of providing the services: elderly and handicapped persons may need specially adapted carriages and services with high costs. People living in isolated areas encounter high costs because of the lack of opportunities to exploit economies of scale.

We will not enter into discussion of the third pricing principle here because it obviously refers to rather specific market segments. Insofar as the first two principles are concerned it is significant that the efficiency principle is strongly connected to the notion of *marginal costs*, whereas the equity 1 concept corresponds to *average costs*. Another difference between the two principles is that efficiency considers all costs, whereas equity 1 usually focuses on the position of the public sector in the distribution of monetary flows into and out of the public budget.

The importance of the notion of marginal costs of transport can be illustrated by comparing them with the well-known lists of the total costs of transport (see Quinet, 1994). For example, the total costs of transport can be estimated by including figures concerning accidents, various types of pollution, congestion, etc. Especially the costs related to accidents may appear as rather high in many cases; the problem with such figures is usually that they ignore the difference between average and marginal costs, and that they are not explicit on the question to what extent they are external. The first point (marginal versus average) is especially clear if we consider the costs of delays due to congestion. The very nature of congestion implies that the marginal costs may be much higher than the average costs (see also Small, 1992 and CE, 1999). Within the category of accidents there may also be a substantial gap between average and marginal costs. An extra car km may lead to more congestion and hence to lower speeds, thus implying lower risks (cf. Blauwens *et al.*, 1995; Persson and Odegaard, 1995; and Shefer and Rietveld, 1997).

The second point is that the failure to distinguish between external and internal costs may lead to a distorted view. For example, it is estimated that most of the accident costs of

transport in the Netherlands apply to costs of damage and costs of health care, which are already paid by the causal agent of the accidents[1] (SER, 1999). These costs are of course still important as determinants of transport volumes, but they do not deserve special attention in transport pricing policies.

3. Transport in the Netherlands.

Before discussing pricing issues in the Netherlands, we give a concise presentation of developments in road transport (see Table 1). During the period between 1986 and 1997, car transport increased by about 29%. During the same period, the number of casualties and emissions of NO_x decreased, implying a case of both absolute and relative decoupling. The progress in NO_x emissions has been the result of the gradual introduction of catalytic converters. One observes an example of relative decoupling for CO_2 emissions where grow slightly slower than transport volumes. This outcome is the result of two countervailing forces: a gradual improvement of energy efficiency of cars -combined with a gradual increase of the average weight of cars- due to higher consumer demand for comfort and safety. A clear outlyer is the rapid development of travel time losses on expressways; an increase in total travel volumes of 29% leads to an increase of travel time losses of no less than 73%. This underscores the non-proportionality between travel volumes and travel time losses, and implies that an increase of travel volumes of 1% leads to an increase of travel time losses of about 2.2%.

Table 1. Developments in road transport in the Netherlands (1986-1997)

	Index 1997 (1986=100)	Decoupling absolute	relative
Travel time losses on expressways	173	no	no
CO_2	125	no	yes
NO_x	61	yes	yes
Casualties	76	yes	yes
Reference variable: Passenger car km	129	-	-

Source: CBS, AVV

Table 1 emphasises that in particular cases (NO_x) technology can be quite instrumental to help solve transport related problems. However, in the case of CO_2 technology, effects have been offset by other developments for the problem of congestion. Technology can also offer some solutions in the form of various telematics applications in order to improve the level of information on the present or expected congestion (cf. Emmerink, 1998). Technological progress will not occur automatically, however. Consistent price signals to the developers of

[1] One might argue that health care costs are not covered by the causal agent since they are paid via the health insurance, the premiums of which are paid by all citizens without differentiation according to travel behaviour. A similar remark can be made for the disability allowances. However, with the introduction of resettlements where the health insurance companies and the disability allowance funds claim the expenses with the travel insurance companies, this problem has been overcome to some extent.

vehicles and the consumers will accelerate the introduction and adoption of new technologies.
In table 2 we compare some external effects of transport with a number of features of drivers, vehicles and infrastructure. That the levels of the external effects usually depend on each of these factors is noteworthy. For example, noise nuisance imposed on citizens in the area depends on number of kms driven, road type (location of nearby dwellings), car type, time of day (during the night nuisance may be higher), and driving habits, such as speed and acceleration behaviour. A similar result is found for most of the other external effects of transport. This table leads us to an obvious conclusion: it is not meaningful to speak of one uniform level of external costs of car transport, because the actual level may vary strongly according to a large number of situational circumstances.

Table 2. Determinants of the external costs of transport

	number of kms driven	road type	car type (technology)	time of day	driving habits
Noise	xx	x	xx	x	x
Accidents	xx	xx	x	x	xx
Pollution	xx	x	xx	x	x
Congestion	xx	xx		xx	

Legend: xx Strong impact
x Impact

It is interesting to compare this result with the actual pricing of mobility in the Netherlands. In table 3 we compare the Netherlands with two other European countries (Switzerland and Spain) and observe that a substantial part of total tax payments allotted: they are paid once when a new car is purchased and regularly when one owns a car, but these payments do not depend on actual vehicle use.

Table 3. Taxation of car transport in various countries according to source (%), 1997

	new vehicles	vehicle ownership	vehicle use (fuel)
The Netherlands	31	24	45
Switzerland[2]	10	19	67
Spain	4	13	83

Source: NVWB

When we draw a parallel between the Dutch situation of taxation and the various factors outlined in table 2, we see that fewer than half of the total tax receipts correspond to the use of cars. A strong differentiation takes place with regard to the fuel inputs: taxes on diesel and LPG are relatively low per litre, while the taxes on owning cars that use these fuels are relatively high. Taxes also vary according to car type: owners of heavy cars pay higher taxes. No differentiation takes place according to type of road (toll roads are almost non-existent in the Netherlands), time of day (no use of congestion pricing) and according to driver's

[2] The figures for Switzerland do not add to 100 because payments of tolls are not included.

features (there may be some differentiation in insurance premiums, but this is handled by the insurance companies, not the public sector).
We conclude that the present structure of Dutch car taxes is mainly aiming at influencing the choice of car technology, and much less at the actual intensity of car use. The structure of the tax system in the Netherlands is only vaguely related to the differentiation in the external effects. Especially for the most rapidly developing problem of congestion, (see Table 1), the tax system is not very helpful. Part of the problem is that the fixed part in the total taxes is rather low. This has led to the issue of variabilisation of transport taxes as discussed in the next section.

4. Variabilisation of transport charges.

4.1. Introduction.

Variabilisation is a budgetary neutral shift of fixed to variable taxes. Budgetary neutrality means that the total tax receipts remain constant. In the case of inelastic demand for transport, this concept can be applied in a straightforward way, since when the volume of transport is given, one can easily compute the consequences of a reduction in the fixed costs for the increase in variable costs. However, when demand is elastic (and when elasticity for variable costs is higher than for fixed costs), such an increase in variable costs would lead to a decrease in transport volumes. Thus, in order to keep the total tax receipts constant, the increase in variable costs should be larger with elastic demand compared with the case of inelastic demand.
Budgetary neutral tax reforms are expected to be better received in the political arena compared with a simple increase in taxes. Budgetary neutrality is a simple example of a policy package approach with a mixture of attractive and unattractive elements. There is clear evidence that in the field of road transport drivers prefer schemes of variabilisation where the additional receipts flow back to the group paying the money, compared to schemes where the additional receipts are used for purposes where other people may also benefit. Examples of the latter are a general reduction of the income tax, or investments in public transport infrastructure (Verhoef *et al.*, 1997b). The obvious result of variabilisation is that travellers who travel long distances per year are confronted with higher costs. Travellers with distances below the break-even point would benefit from budgetary neutral tax reforms.
A few obvious candidates for variabilisation that have received attention in the Netherlands are an increase in:

- Fuel tax (petrol, diesel, LPG)
- Congestion pricing
- km charge
- Tolls
- Parking
- Tradable permits
- Trip charge

In the next subsections these variabilisation alternatives will be discussed in greater detail.

4.2. Fuel tax.

The fuel tax in the Netherlands has been used several times in the context of variabilisation. The most recent case was in 1996, when the petrol tax was increased by about 8 Eurocents, (suggesting a 7% increase in the total petrol price). The basic problem with the use of fuel tax in the Netherlands is that neighbouring countries have lower petrol taxes (the difference with Germany is about 15 Eurocents). This leads to substantial flows of Dutch residents fuelling in neighbouring countries. Because fuelling is often combined with shopping, there is a negative effect on total tax receipts and on the economy in the border regions.

This is an interesting case of fiscal competition (Kanbur and Keen, 1993). It is not difficult to see that small countries can benefit from fiscal competition by fixing low tax levels on products such as petrol. The reduction in total tax receipts from domestic consumers is more than compensated for by the receipts from foreign consumers. This strategy is followed, for example, by Luxembourg, which indeed results in a substantial increase in total tax receipts for that country (cf. Rietveld *et al.*, 2000). The Netherlands, although a rather small country, followed exactly the opposite strategy and raised their fuel tax to about Euro 0.70 per litre.

One possible way to overcome the tax competition model is for the high tax country to introduce a spatially-graduated scheme -with fuel tax levels at the border being equal to the level in the neighbouring country- and with gradually increasing levels as one moves away from the border. As shown in Rietveld *et al.* (2000a), however, this strategy is not problem-free. A point to be taken into account is that the slope of the graduation profile should not be too steep, because otherwise Dutch car drivers would be motivated to make domestic fuel fetching trips. In addition, even if the graduation profile were rather modest so that fuel fetching is not profitable, difficulties may emerge since some drivers are simply unaware of the full costs of fuel fetching trips. Another difficulty is that even in the complete absence of fuel fetching trips, drivers will adjust their fuelling behaviour if they are confronted with graduation of fuel taxes. One might expect a shift away from fuelling near the place of residence to fuelling in the places one already had visited regularly and that now happen to have low fuel taxes. This would result in rather drastic reductions in the total returns of some fuel sellers, which therefore makes spatial graduation a difficult policy to implement.

The conclusion is clear: a small country such as the Netherlands with densely populated border areas cannot afford to have fuel prices substantially above those of neighbouring countries. Spatial graduation of fuel taxes does not solve the issue. Perhaps a better solution would be to give smart cards to car users in border regions, thus enabling them to buy fuel at prices similar to those in the cheap neighbouring country, but this would nevertheless imply additional implementation costs and possibly bring on fraud problems.

4.3. Congestion pricing.

Road pricing has been high on the political agenda in The Netherlands for the past 15 years. Government proposals have assumed various forms, ranging from low-tech implementations, such as traditional payments of tolls to high-tech electronic toll collection. Policy initiatives have come mainly from the central government, and given the poly-nuclear structure of the Dutch city system, it is no surprise that the proposals involved implementation in more than one city. Congestion on the expressways to the four large cities of Amsterdam, Rotterdam, The Hague and Utrecht, all located in the Randstad -the highly urbanised Western part of the country- has indeed increased considerably during the past decades.

The first proposal launched at the end of the 1980s involved a fee to be paid in an electronic way for passing two cordons around the above mentioned cities during peak hours. This proposal led to extensive debates on the technical feasibility of the system, the problem of rat-running (traffic diverted to the underlying road network in order to avoid the payment of fees), and the problem of privacy. The proposal met with heavy criticism and was replaced by a much more modest proposal in the form of conventional tolls. Meanwhile, on certain expressways new road capacity was built to create dedicated lanes for freight traffic, since this sector was considered to be most affected by the congestion problems[3].

A flaw with conventional tolls was that they would require the construction of large toll plazas, which would not be easy to construct, given the high population density of the regions. Therefore, in a subsequent stage, the government formulated the idea of introducing a seasonal license to pass the cordons, thus removing the problem of finding land for the toll plazas. A problem with this proposal was that its effectiveness was likely to be small: the large majority of regular users would simply regard the seasonal license as another tax on car ownership, therefore implying that there would be little effect on its use. Once the license was bought, it would not impact on the use of the car during peak hours.

A new government returned to the high-tech proposal in 1995; they anticipated the introduction of electronic tolls around the four major Dutch cities in the year 2001. Again a cordon system was proposed (with one or two cordons). The system was only envisioned for the morning peak hours between 7.00 and 9.00 a.m., with a flat fee of about US$ 2.50 for those who pay electronically and US$ 3.50 for those who pay otherwise. The proposed system resembles the ERP (electronic road pricing scheme) implemented in Singapore in 1998. In order to be able to pay the low tariff, the car driver needs a transponder in his car which can charge an equivalent of US$ 2.50 to a smart card when the car passes the cordon during the morning peak. Equipment along the road is required to check whether the car indeed has a well-functioning transponder and a smart card with a sufficient amount of money. If the result is negative, cameras photograph the number plate of the passing car and via a computerised system bills of US$ 3.50 per crossing are sent to the car owner's address.

A constant feature of the various proposals has been that cordons are fairly distant from city centres. In most cases the proposed distance is about 7.5 to 20 km away from the centre. Given the fairly small size of the Dutch cities under consideration, (with inhabitants numbering between 500,000 and 1,000,000), this means that the toll points would all be located outside the cities. This scenario implies a spatial setting which is somewhat different from that of Singapore, where the cordon is much closer to the centre.

When the government launched its 1995 road pricing proposal, they announced that receipts would be channelled back to the groups that paid the bill, designating a clear example of variabilisation. When a new government was formed in 1997, road pricing was still part of the government programme, but this time the receipts were proposed to be returned to the entire population via a general reduction of the income tax as part of a larger tax reform.

In 1998 heated opposition against the road pricing proposals took place, initiated among others by the association of car drivers and the association of larger firms. The major

[3] In reality the share of trucks that are stuck in traffic is relatively low since many truck drivers tend to leave early in the morning in order to avoid congestion. In addition, long distance truck drivers may take a rest during peak hours. This does not mean to say that the congestion costs related to freight traffic are small: the policies of firms and drivers to prevent that trucks get stuck in traffic obviously have cost implications.

complaints against the road pricing proposals were in this case that they would not work - because of a lack of travel alternatives drivers were expected to be insensitive to the fee- and that costs for implementation, including transponders and equipment along the road would be too high. The opposition compelled the minister of transport to adjust the plan: instead of a full-scale implementation around the four cities, he proposed that a test be carried out around only one city. At the time of writing this article it is not yet known which of the four cities will volunteer.

As part of the debate, opponents against the road pricing proposals formulated alternatives such as 'pay lanes'. Instead of the situation where all cars entering the city would pay a toll, the pay lane alternative stipulated that a toll would only have to be paid for using particular lanes. The other lanes would remain free, thus leaving a choice to car drivers as to whether they want to pay. One inadequacy with the pay lane alternative is that if it were to be introduced at given levels of capacity, it would aggravate the level of congestion on the lanes where no charge is paid, because a shift may be expected from the pay lanes to the free lanes.

A situation such as pay lanes can only be expected to operate smoothly if those who use pay lanes have values of time which are much higher compared to those who do not use the pay lane. Also, the pay lane approach may lead to the rat-running problem, whereby car drivers encountering expressway congestion begin using local roads.

In those areas where new capacity is created, it is obviously easier to introduce 'pay lanes'. A problem may be, however, that where new capacity is available (for example, a second tunnel under a major waterway), there is in the short run excess capacity and congestion levels are low, consequently leading to small traffic volumes in the pay lanes. But in the long run, with an autonomous increase of traffic, this option may become attractive, however. A general finding of capacity improvements is that congestion problems shift from one place in the network (a bottleneck such as a bridge or tunnel) to another place (a junction at the end of the link where the bottleneck was removed), cf. Rietveld and Bruinsma (1998). Then it would be better to impose a toll near the new bottleneck instead of at the location where the previous bottleneck existed.

The conclusion is that a large-scale introduction of road pricing in the Netherlands is not probable in the short term. A more likely scenario is the gradual introduction of road pricing schemes as observed in the USA (see, for example Small and Gomez Ibanez, 1998 and Richardson and Bae, 1998). The role of pricing as an instrument for alleviating congestion problems has been limited thus far, but it is expected to improve.

4.4 Kilometre charge.

Another way to introduce variabilisation is a kilometre charge. An important reason to introduce the kilometre charge is that it is less sensitive to the border problem discussed in section 4.2. The basic idea now under investigation in the Netherlands is that every car be supplied with an electronic device that counts the number of kilometres travelled. With a certain frequency car drivers pay the tax, which is computed as the product of the number of kilometres travelled and the charge per km.

In this simple form the system can indeed help to reduce the fixed share in the total car tax. However, its degree of differentiation would be minimal. It would for example not differentiate between cars according to their degree of fuel efficiency. If it were to be used simultaneously to replace fixed taxes, which do have a clear differentiation according to fuel

efficiency (heavy cars pay higher taxes than light cars), the effect on technology choice would be different. It is not difficult to introduce a system where the charge per km is differentiated according to the type of car. To add other differentiations will be more demanding, however. For example, if one wants to introduce differentiations according to all the dimensions mentioned in Table 2, a more refined system needs to be introduced, implying the possibility of communication between the device in the car and devices outside it. The latter devices would inform the in-car device of the level of the charge to be applied, differentiated according to time of day, noise sensitivity around the road, level of congestion, etc. Road pricing in this variant (see section 4.3) would simply be one of many considered aspects[4].

What are the foreseen bottlenecks in this approach? A first point of attention has to do with the use of technology. The probability for a failure in the system should be very small, and it should also be fraud proof. The recent initiative of the Swiss government to introduce a kilometre charge for freight transport in the year 2001 means that from a technology viewpoint the system is considered to be feasible (see also Rietveld, *et al.* (2000b). Another sticking point are the border effects that arise in the event that other countries also adopt a km charge. About 10% of the mileage of Dutch cars takes place in foreign countries and is driven during holiday trips. There is no immediate reason for the devices to be deactivated while the cars are abroad. But one has to consider the case of foreign cars used in the Netherlands, and in particular, the possibility that people introduce cars with foreign number plates in the Netherlands (about 1% of all cars in the Netherlands have a foreign number plate). There is little reason to bother about incidental foreigners visiting the Netherlands. The case of Dutch residents using foreign number plates is a more serious threat to the system, but that is not very different from the present situation. Another theoretical possibility is that Dutch residents would move to one of the neighbouring countries. Given the differences in income tax, some Dutch citizens have moved to places just across the border in Belgium in the past. But it is rather improbable that the economic importance of mobility taxes would be large enough to justify such a move.

An important question seems to be the frequency of payment of the tax. The present car-ownership tax -being a constant number- is paid once every three months. The easiest way to deal with this situation seems to be from the perspective of the standard policy of suppliers of a public utility such as electricity companies, and to charge a fixed monthly amount based on past consumption with a final bill at the end of the year based on the actual number of kilometres driven during the past period. An obvious disadvantage of this approach is that its effect on behaviour is small because it is only once a year that the consumer is confronted with the real bill. The alternative of more frequent measurement of the actual kilometrage will be more costly, however. One means of improving the behavioural effect would be to supplement the in-car device with a meter informing drivers about the accumulated tax amount. In the event that a second-hand car is sold, part of the process must include the settlement of the remaining tax. A system with prepaid kilometre points, similar to what is used in mobile telecommunication would be another approach to solve this problem.

[4] The obvious advantage of a differentiated kilometre charge for drivers outside congested regions (still the large majority in most countries) would be that they are confronted with clearly lower charges than drivers in congested regions.

4.5 Other measures of variabilisation.

In addition to the three examples of variabilisation discussed above, there are also forms of policy that deserve to be mentioned. Tolls are exceptional nowadays in the Netherlands, but a certain increase in private sector involvement in infrastructure supply and management may be expected. This will lead to an increase of the use of tolls.

Parking has recently become a very dynamic field in transport pricing. The difference between parking measures and the measures mentioned in sections 4.2-4.4 is that it is the municipality rather than the central government that collects the taxes. The large cities have become very active in the collection of parking fees, not only in the central shopping areas, but also in large areas of cities where the residential function is dominant. In a strict sense, the collection of parking fees is not part of a variabilisation formula. In a broader sense, one might however still speak of variabilisation, since an increase in tax receipts based on parking may lead to a reduction in taxes on real estate. Parking fees can be considered as a second-best solution to congestion pricing. In a very stylised model there is a one-to-one correspondence between the imposition of a congestion fee and a parking fee. However, there are at least three respects in which parking fees and congestion charges differ. First is that parking fees only apply to public parking space; cars parked on private lots remain unaffected. Secondly, parking fees are not differentiated according to the origin of the trip to the parking place as the destination. Many cars parked in a city will be driven by persons living in the city itself and who are not responsible for the expressway congestion around the cities. Thirdly, parking fees tend to depend on the length of the parking period; this does not necessarily correspond with the congestion caused by the use of the car, which essentially depends on the timing of the trip. We conclude that parking fees are a somewhat crude measure to address congestion.

Tradable permits may be another means of introducing the essence of variabilisation. These permits might correspond to the right to buy fuel (making the effective price of fuel higher), the right to drive kms per transport mode, etc. For a review, I refer to Verhoef *et al.* (1997a). When the rights are distributed free among a certain target group, (for example all adult citizens, all car owners, etc.), there is no money transfer from the private sector to the public sector which may reduce the problem of trust mentioned above. The problem that people do not trust that the government will channel tax receipts back to the private sector disappears in this case. What remains, of course, is that within the group of actors who receive the permit, trade will develop and consequently lead to net positive and negative outcomes for various groups. For example, a positive result is found for those who do not alter their travel behaviour and who sell the permits they have; a negative result holds for those who do not change their travel behaviour and who buy the permit[5]. Within the intermediate group of people who change their mobility behaviour some people will benefit, others will be affected negatively.

Finally, in the debate on the pricing mobility, the proposal has recently been made to introduce a trip tax on car use. This would lead to a relatively strong increase in the price of short trips. From an externality viewpoint this approach may be attractive, since short trips tend to have relatively high external costs (noise in densely populated areas, accidents in

[5] These results hold true when we ignore the benefits of road pricing, implying that travel times will decrease. In that case the persons who continue to travel may benefit when their value of time is high enough so that the monetary evaluation of the time gains outweigh the money paid to use the congested road.

residential areas, high emissions due to the cold-start phenomenon, etc.). A trip tax is easy to implement as a fixed element of a parking fee in a public parking space. The tax would, however, lead to high costs of implementation in areas where public parking is free, and would also eventually necessitate the introduction of a payment system on private parking space, including parking at the place of residence.

5. Other sectors

In the above section various approaches to pricing road transport have been discussed. By comparing the Dutch tax level with that in other countries, it is apparent that the average level is high. That other transport modes have received little attention in price policies thus far is striking. For example, public transport has been a recipient of subsidies for a long period. However, the pressure to stimulate technological progress in order to reduce the environmental burden has been limited; this means that technological progress in these fields has been fairly low.

A case of special significance is aviation. Compared with road transport, the taxation of aviation has been extremely low in Europe, including the Netherlands. The fuel tax is almost non-existent, and the value added tax on aviation tickets is zero. The background of this situation is obviously the international character of aviation: the co-ordination of taxation measures is needed to avoid adverse effects related to fuelling patterns. There is certainly reason to worry about the environmental consequences of aviation. The contribution of aviation to emissions is rather low at the world level (about 4% for CO_2 and NO_x, lower for other types of emissions, see Fransen and Peper, 1993). But, aviation is growing rapidly and part of the emissions occurs in the stratosphere where the ozone layer is located.

Taxation of aviation is now focussing on local nuisance aspects (mainly noise). In the Netherlands tax receipts are used for noise insulation of dwellings affected by airports, but the non-local effects receive little attention. This makes aviation a relatively privileged transport sector that is not sufficiently motivated to improve its environmental and energy performance.

6. Distortions due to the fiscal system.

The aforementioned comparison of the pricing structure of transport with the structure of its costs leads us to the conclusion that there is a clear lack of correspondence between the two. We discuss a related theme below, i.e., distortions that are the consequence of the income tax and its deductibles. We pay special attention to the treatment of the company car and to commuting costs.

6.1. Company cars.

In the Netherlands company cars have a high share (43%) in total annual sales of new cars (see Table 4 for an international comparison). The number of company cars in the total stock is lower, however, since company cars are usually sold to other users after a few years. Assuming that company cars are used for three years before they are sold to other users, and

that the average life of cars is approximately 12 years (ignoring differences in expected lifetime of cars that begin as a company car or as another car), we find that the share of company cars in the total stock is about 10%. The importance of company cars for the composition of the total national fleet is higher of course, because in a steady state, 43% of all cars started as a company car. The choice of particular features of company cars such as engine power, acceleration capacity, fuel efficiency, and safety performance remains to have its impact on aggregate figures during the entire lifetime of the cars (see also Rietveld and Van Ommeren, 1999).

It should be noted that the percentage in total mileage of company cars is higher than the figure of 10% mentioned above, because company cars are known to have above-average annual mileage (about 25,000 km per year compared with 16,000 km per year for the average car in the Netherlands, see Pepping *et al*, 1997). The well-known fact that the mileage of new cars is higher than that of older cars can thus be partly explained by the fact that many new cars are company cars.

Table 4. European company car fleet market, new cars sold in 1995.

country	total business purchases ('000)	total market share (%)
Austria	104	37
Belgium	126	32
Denmark	45	31
Finland	31	38
France	950	46
Germany	1520	46
Ireland	32	37
Italy	506	30
Netherlands	193	43
Norway	29	32
Portugal	85	42
Spain	233	28
Sweden	85	50
Switzerland	109	41
UK	1030	53
Western Europe	5069	42

Source: The Economist Intelligence Unit

Fiscal arrangements of the company car in the Netherlands are such that a certain amount of money is added to taxable income of the user. This amount is proportional to the price of the car. Most companies do not charge the users for the use of the company car. This means that the user experiences a marginal price per km that is equal to zero. For the employer this fringe benefit construction is interesting because it is a cheap way to provide extra income to a group of employees. The marginal tax rate paid by these employees is 60%. In many cases the company car arrangement is advantageous for both the company and the employee compared with the situation where the individual would have to pay for buying and maintaining a car.

The alternative is that employees own the car themselves and use it for business purposes. The fiscal authorities allow a compensation of about 29 Eurocents per km in this case.

Higher compensations would become part of taxable income. This figure of 29 Eurocents is based on the average costs of car use. The variable costs per km are much lower, however: about 13 Eurocents. The conclusion is that compensation of car kms is an inexpensive way for employers to increase the income after taxation for employees. The consequence for employees is that every km travelled for the firm has a net price of -16 Eurocents, which will obviously not stimulate car users to reduce their volumes of car kms driven. This fiscal arrangement affects a rather broad group of car users: it appears that approximately 24% of all cars are used from time to time for company purposes (most of them only occasionally).
To give a further indication of the importance of company related traffic we mention the following figures. In the Netherlands about 34% of all cars are involved in business-related trips. These cars are obviously responsible for all business kms; further on these cars are used for about 50% of all commuting kms, and about 35% of all other kms driven.

6.2. Commuting.

Commuting is another area where fiscal arrangements have an adverse effect on the pricing of mobility. Within the Dutch fiscal system commuting costs are -within certain limits- deductible in the income tax. The background of the deductibility is that commuting costs are considered to be part of 'professional expenses' which are tax deductible. The effect is, of course, that the incentive for employees to move to a dwelling closer to the workplace is reduced. A possible historical explanation may be that after World War II, the housing market was so tight in many places that workers could not find a place of residence near their work. The deductibility has been a subject of political debate for many years. The proposal for a partial abolishment of the tax deductibility of commuting costs even led to the resignation of the Dutch government in 1989.
In the present system the deduction possibilities are highest in the case of the use of public transport, but car travel commuting costs are also deductible up to a distance of 30 kms. The consequence is that commuters who travel by car are not faced with variable costs of about 13 Eurocents per km but only 9 Eurocents.
Most of the commuting trips occur during the morning and afternoon peak hours, when the marginal costs of transport are relatively high (external congestion costs for the car; high costs for the public transport suppliers, since the peak period determines the total capacity needed). We find that the income tax leads to a strange distortion: via a fiscal measure transport costs are reduced during the peak, which is exactly the time period that these costs are highest.

7. Conclusions.

Externalities of transport not only depend on the number of kilometres driven, but also on factors such as road type, time of day, car type and on driving behaviour such as speed and acceleration. The present pricing system of car use and ownership in the Netherlands is such that the degree of differentiation is small, except for the car type aspect. Thus there is a clear mismatch between the differentiation in external costs and in pricing. A considerable share (55%) of all car-related taxes in the Netherlands relates to car ownership. The rest (45%) is paid for car use. The structure of the tax system is only vaguely related to the differentiation

in the external effects. The tax system is not very helpful, especially for the most rapidly developing problem of congestion.
Variabilisation has been a main objective during the past 20 years or so in the Netherlands. Potential tools are fuel taxes, congestion pricing, a kilometre charge, and paid parking. The potential of the fuel tax is limited in this respect as long as neighbouring countries have lower fuel prices. Spatial differentiation of fuel taxes within the country to solve the border problem has large negative side effects. Congestion pricing has been on the political agenda for over 10 years, but it has not received sufficient social and political support up to now. A kilometre charge has been proposed recently as an alternative measure, but its merits depend strongly on the question of how differentiated it can be. A flat charge will probably be rather ineffective in alleviating the external effects of road transport. Paid parking, implemented by municipalities has been a very dynamic policy field during the last decade.
The treatment of transport costs as a deductible in the income tax leads to major distortions: a low variable cost for commuting, a zero variable cost for the company car, and a negative cost in the case of private car use for business purposes. It is interesting to compare these low effective costs with the rather low price elasticities of transport demand found in the literature (Pepping *et al.*, 1997). The models on which these price elasticities are based do not take into account the fiscal arrangements discussed above. This lack of explicit attention to the fiscal aspects makes the transport models less suitable to study the effects of changes in fiscal structure.
In this paper we have highlighted two major problems in the taxation of road transport in the Netherlands: lack of differentiation so that the tariffs reflect the external costs, and adverse effects of the structure of the income tax in the fields of business traffic and commuting leading to low, zero or even negative costs of car use. The first issue is the prime responsibility of the Ministry of Transport; the second issue is the commission of the Ministry of Finance. Discussions on the reform of transport-related taxes generally focus on the first problem but the figures presented in this study indicate that the second problem also deserves high priority.
Another major finding is that much of the discussion on the proper taxation of transport in the Netherlands is focussed on car use. The proper pricing of other modes such as freight transport, public transport and aviation deserve more attention, however, and it is here that even greater distortions may be expected.

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